4.5 EARTH RESOURCES

This section evaluates the potential geological impacts that could occur with implementation of the project. Preliminary geotechnical investigations of the proposed Central Health Service Center (CHSC) project site were performed by Rutherford & Chekene Consultants in 2002 and by Kleinfelder in 2007. The following provides a summary of the results of the preliminary geotechnical investigation. Additionally, past geotechnical reports for other areas at San Quentin State Prison (SQSP) have been prepared and are summarized below as relevant to the CHSC. A copy of these reports is available for review at the California Department of Corrections and Rehabilitation (CDCR), 501 J Street, Room 304, Sacramento, California.

4.5.1 EXISTING CONDITIONS

GEOMORPHIC SETTING

SQSP is located on the southern shoreline of Point San Quentin, along the northwestern margin of San Francisco Bay. The San Francisco Bay region is bordered by mountain ranges of the Coast Range geomorphic province. The general vicinity of the SQSP is located on a broad plain (old marshland basin) that slopes gently from the hills to the north to the San Francisco Bay margin to the south. Topographic maps dating back to 1926 indicate that approximately half of the proposed CHSC project site was originally part of San Francisco Bay and consisted of tidal marsh/flats (Geo/Resource 1990, cited in CDCR 2004). The soils at SQSP consist of Quaternary fill, which is generally composed of clay, silt, sand, rock fragments, organic material, and/or human-made debris. The hills north of the CHSC site are underlain primarily by Franciscan mélange, which is a complex mixture consisting of small to large pieces of resistant rock embedded in a matrix of pervasively sheared or pulverized rock material (Kleinfelder 2007). It is generally composed of sheared shale and sandstone containing hard inclusions of greenstone, chert, greywacke, and their metamorphosed equivalents (CDCR 2002).

The area underlying the western and eastern sides of Building 22 are relatively flat and perpendicular to the building; however, the eastern side is approximately 25 feet higher than the western side. A 24- to 25-foot high retaining wall forms the lower part of the east building wall (Kleinfelder 2007). Based on the earth materials encountered during the soil borings (Kleinfelder 2007), the western and eastern sides of Building 22 have distinct subsurface conditions, as follows:

- Western Side of Building 22: Bedrock depth below existing grade varies from 1.5 feet at the southwest end to 5 feet at the northwest. The bedrock is overlain by undocumented fill and/or residual soil.

- Eastern Side of Building 22: Bedrock depth below existing grade varies from approximately 13.5 feet at the southwest end to 21.5 feet at the northeast end. The bedrock is overlain by weak, undocumented fill varying thickness from 13 to 20 feet. The fill consists of a mixture of sand, gravel, clay, and bricks.

SEISMICITY

The Coast Range geomorphic province is a seismically active region characterized by northwest-trending faults that are a reflection of the dominant northwest structural trend of the bedrock in this region. Since deposition, the bedrock materials have been subject to faulting and folding (Kleinfelder 2007). There are three active faults located near the CHSC project site. The uplift of the Coast Ranges and associated seismic activity is the result of movement along the San Andreas Fault System that consists of three major active fault zones. These zones include the active San Andreas, San Gregorio, and Hayward faults (9.6 miles west, 10.5 miles west, 8 miles east of the project area, respectively) (CDCR 2002). These are historically active faults within the San Andreas fault system, which means that they have been active within the last 200 years. Active fault traces associated with these fault zones include the Rogers Creek fault, Green Valley fault, and Concord faults, which are located 14.5 miles northeast, 24 miles northeast, and 22 miles northeast of SQSP, respectively (CDCR 2004). A trace of the potentially active San Pablo fault was mapped approximately 5 miles northeast of SQSP (CDCR 2004).

Kleinfelder (2007) performed a historical earthquake database search and determined that between the years of 1800 and March of 2007 there were 182 earthquakes that exceeded a 4.0 magnitude within 62 miles (100 km) of the project site. The strongest earthquake in the Bay Area during historic time was the 1906 earthquake on the San Andreas fault. This earthquake had a Richter-scale magnitude of approximately 8.3. The most recent strong earthquake that affected the Bay Area was the Loma-Prieta Earthquake in 1989, which had a magnitude 7.1. The epicenter of this earthquake was located approximately 68 miles southeast of SQSP. Structures on the project site and in the immediate vicinity suffered no apparent damage (CDCR 2004).

The Hayward fault has generated two historic earthquakes of approximate magnitude 7, in 1836 and 1868. An earthquake occurred along the Calaveras fault (a fault zone located 25 miles northeast of the project area [CDCR 2001]) in 1861 with an estimated magnitude of 5.6 (CDCR 2004). Table 4.5-1 lists the estimated maximum credible earthquake magnitudes and the Uniform Building Code Fault Type. The Maximum Moment Magnitude Scale is used by seismologists to compare the energy released by earthquakes. Faults with an “A” classification are capable of producing large magnitude earthquakes with a magnitude greater than 7.0 and have a high rate of seismic activity.

Table 4.5-1
Estimated Earthquake Magnitude Parameters for Major Earthquake Sources Near Project Site

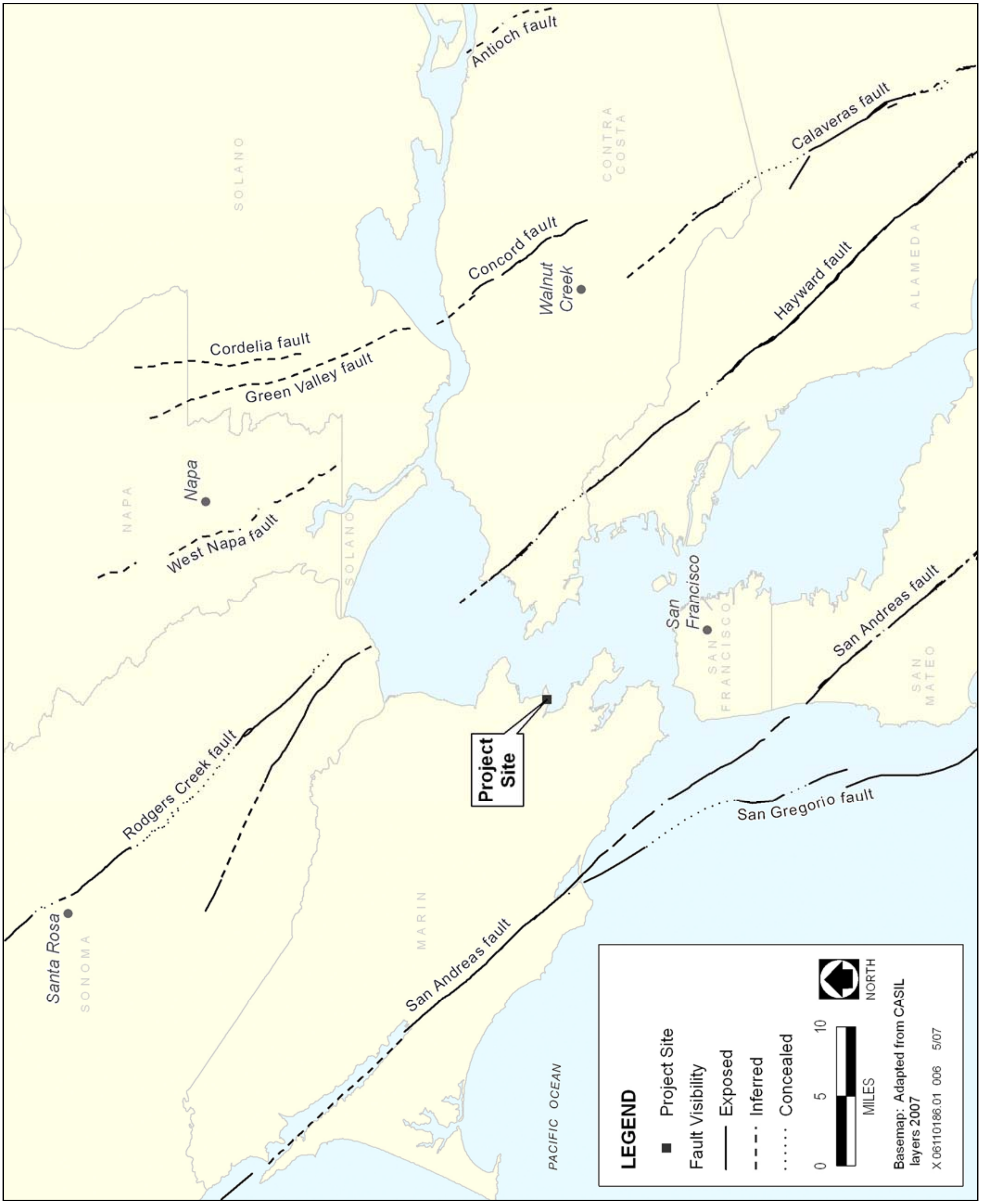
Fault	Maximum Moment Magnitude	1997 Uniform Building Code Fault Type	Estimated Slip Rate
Hayward	7.3	A	9 mm/year
San Andreas	7.9	A	24 mm/year
San Gregorio	7.4	A	5 mm/year

mm/year = millimeters per year
Source: California Department of Mines and Geology 1998, cited in CDCR 2002

It is estimated that there is an approximate 70% chance of one or more major (moment magnitude of 6.7 or larger) earthquakes in the San Francisco Bay region by the year 2030. The estimates on the probability of a major earthquake before the year 2030, caused by rupture of the Hayward-Rodgers Creek fault system, the San Andreas fault, and the San Gregorio fault, are approximately 32%, 21%, and 10%, respectively (CDCR 2002). See Exhibit 4.5-1 for a map of the regional faults.

The California Department of Mines and Geology (CDMG 1999, cited in CDCR 2002) has digitally mapped SQSP as having a peak ground acceleration of between .5 gravity (*g*) and .6 *g* for an event with a probability of exceedance of 10% in 50 years. The State of California Seismic Hazard Zone also mapped SQSP as having a peak ground acceleration of about .4 *g* for a maximum credible earthquake with a moment magnitude of 7.5 on the Hayward fault (CDCR 2002).

There are no known active faults within SQSP boundaries, nor has a known fault been projected to traverse the site. SQSP is not located in an Alquist-Priolo Earthquake Fault Zone (CDCR 2002). However, in response to the Earthquake Safety and Public Buildings Rehabilitation Bond Act (ESPBRBA), the Department of General Services, Division of the State Architect, in consultation with the Seismic Safety Commission and its Professional Advisory Committee, evaluated all state building to determine their susceptibility to earthquakes. Buildings were evaluated and a Seismic Risk Exposure priority was assigned. Building 22 and other buildings at SQSP were evaluated in response to the ESPBRBA. Based on that evaluation, a State Building Seismic Risk Level was assigned. Risk levels are generally determined by the building’s current use, its probable level of seismic damage to the structure, its operating systems, threat to occupants, and its probable usability after a major earthquake event (DGS 2001). Building 22 was assigned a Seismic Risk Level VI, which indicates that extensive damage and probable partial or total collapse of the unreinforced masonry structure is expected in the event of a high



Source: Source: Borcherdy1975; Jennings 1975; Helly and Herd 1977; Herd and Helly 1977

Regional Fault Map **Exhibit 4.5-1**

magnitude earthquake, which as described above, is expected to be experienced at the site (and Bay Area) in the foreseeable future. As such, the building has been determined to be seismically unsafe for occupation under long-term conditions and it was vacated in 2006, with the exception of the library.

LIQUEFACTION

Liquefaction occurs when water-saturated soils composed of silt or gravel are subjected to shaking by an earthquake. Factors determining the liquefaction potential are soil type, level, and duration of seismic ground motions, the type and consistency of soils, and the depth to groundwater. Loose sands and peat deposits are particularly susceptible to liquefaction, while clayey silts, silty clays, and clays deposited in freshwater environments are generally stable under the influence of seismic ground shaking. If the water is unable to drain, the soil assumes the property of a heavy liquid and no longer provides adequate support for foundations, buildings, or upper layers of soil. Liquefaction can cause severe damage to structures as a result of settling, tilting, or floating.

The geotechnical report prepared by Kleinfelder (2007) found groundwater in three borings (HS-1, HS-2, and HS-4) at depths of 10 to 15 feet during drilling. Boring HS-2, at the southwest end of the building, had a measured water level depth of 7.5 feet below the top of the grade after 15 minutes of stand time. Boring HS-4 had a measured water depth of 11 feet; this water level is significantly higher in elevation than the bottom floor of the existing building. Soils that are susceptible to liquefaction were not commonly encountered during geotechnical explorations at the project site (Kleinfelder 2007) and are not anticipated to occur beneath the CHSC. Isolated pockets of liquefiable soil may be present in the soil fills located east of the CHSC; however, this is anticipated to have a negligible and localized affect, if any.

According to the San Francisco Bay Region Geology and Geologic Hazards Susceptibility Map of the San Francisco Bay Area (USGS 2005), the CHSC site does not appear to be located in a liquefaction zone; however, the proposed medical supply warehouse site appears to be located in a very high liquefaction susceptibility zone. Based on the on-site geotechnical investigation performed by CDCR (2002), liquefaction potential at the CHSC site is considered low because of the presence of Franciscan bedrock in underlying soils.

LATERAL SPREAD

Lateral spread refers to landslides that form on gentle slopes as a result of seismic activity and have a fluidlike movement. Soil types that are highly susceptible to lateral spread include silts and shale. There may be potential for lateral spread in the overlying sand and silt fills and any sand layers that may be present at SQSP. Soils at the CHSC site consist of soft to stiff, sandy/gravelly lean clay, which overlies highly weathered and sheared Franciscan rock (CDCR 2002). Sand/silt soils with low plasticity (Plasticity Index of 6–10) were found throughout the upper soil layers near the proposed warehouse project site (Geo/Resource Consultants 1990, cited in CDCR 2004).

EXPANSIVE SOILS

Expansive soils are soils that swell when subjected to moisture. Shrink/swell potential is the relative change in volume to be expected with changes in moisture content; that is, the extent to which the soil shrinks as it dries or swells when it gets wet. The extent of shrinking and swelling is influenced by the amount and kind of clay in the soil. Shrinking and swelling of soils causes damage to building foundations, roads, and other structures. Soils at the CHSC site consist of soft to stiff, sandy/gravelly lean clay, which overlies highly weathered and sheared Franciscan rock. An evaluation of expansive soil for the CHSC was not provided in CDCR's (2002) geotechnical report. Sand/silt soils with low plasticity (Plasticity Index of 6–10) were found throughout the upper soil layers near the proposed warehouse project site (Geo/Resource Consultants 1990, cited in CDCR 2004). Based on these findings, there could be a high probability of shrink/swell potential at the CHSC site and a low probability of shrink/swell soil potential at the warehouse site (Hallenbeck/Allwest Associates 2004, cited in CDCR 2004).

SOIL CORROSIVITY

Soils with high moisture content, high electrical conductivity, high acidity, and high dissolved salts are most corrosive. Laboratory test results performed by CDCR (2002) from soil and rock samples from the CHSC site indicate that the potential impact of corrosion hazard to concrete is low, but the potential corrosion hazard to steel and other metals is high. Therefore, the report recommends that corrosion protection should be provided for all buried iron, steel, cast iron, ductile iron, galvanized steel, and dielectric coated steel or iron utility lines. While no on-site soil corrosion studies have been performed for the warehouse site, resistivity measurements and chloride concentrations found in bay mud deposits near the proposed warehouse site could create a corrosive environment for steel pipes and steel reinforcement in concrete. During the life of the project, reinforced concrete foundations, driven precast pilings, and culverts could be adversely degraded by the corrosive nature of the bay muds (Geo/Resource Consultants, Inc. 1990, cited in CDCR 2004).

LANDSLIDES

SQSP is located in a relatively flat area and is not located in a State of California Seismic Hazard Zone for landslides (CDCR 2004).

TSUNAMIS

A tsunami can be caused by an offshore earthquake, volcanic activity, or landslide. Tsunamis can inundate low-lying areas and cause extensive erosion and the deposition of sediment. Facilities that are poorly constructed can be severely damaged by the incoming and outgoing waves. The project site lies in an area that could be inundated by tsunami waves if the waves are substantially large (i.e., greater than 20 feet). A tsunami wave could result in a wave runup at SQSP of approximately 15 feet with a recurrence interval of 475 years (design level interval) and a maximum of 20 feet with a recurrence of 950 years.

Based on ground elevations along the shoreline of SQSP and assuming a tsunami runup of 15 to 20 feet at SQSP, it is estimated that various areas of the shoreline at SQSP could be subjected to various levels of inundation caused by a tsunami. If a tsunami wave has a runup of 15 to 20 feet approaching SQSP, all areas abutting the bay that have ground elevations less than 15 to 20 feet above mean sea level may be subjected to some level of inundation (Hallenbeck/Allwest Associates 2004, cited in CDCR 2004). However, the proposed CHSC site is located outside the 150-foot tsunami wave runup zone, at approximately 30 feet above sea level. The proposed medical warehouse is located at approximately 10 feet above sea level, and would be raised 48 inches during construction, bringing the building to approximately 14 feet above sea level. However, the proposed medical warehouse will not be a habitable structure.

4.5.2 REGULATORY BACKGROUND

FEDERAL

No federal plans, policies, regulations, or laws are applicable to the proposed project.

STATE OF CALIFORNIA

State of California Building Code

All development in the State of California must comply with the provisions of the California Building Code (CBC) at a minimum. The CBC provides minimum requirements for grading, building siting, development, and seismic design. Structures constructed at SQSP would comply with the CBC.

Alquist-Priolo Earthquake Fault Zoning Act

The purpose of the Alquist-Priolo Earthquake Fault Zoning Act is to prevent the construction of buildings used for human occupancy on the surface trace of active faults. The act only addresses the hazard of surface fault rupture and is not directed toward other earthquake hazards. As described above, SQSP is not located in an Alquist-Priolo Earthquake Fault Zone.

Seismic Hazards Mapping Act

The Seismic Hazards Mapping Act, passed in 1990, addresses nonsurface fault rupture earthquake hazards, including liquefaction and seismically induced landslides. The law requires the State Geologist to establish regulatory zones (known as Earthquake Fault Zones) around the surface traces of active faults and to issue appropriate maps. As described above, SQSP is not located in a State of California Seismic Hazard Zone.

REGIONAL

No regional plans, policies, regulations, or laws are applicable to the proposed project.

COUNTY OF MARIN

No County of Marin plans, policies, regulations, or laws are applicable to the proposed project.

4.5.3 ENVIRONMENTAL IMPACTS OF THE PROJECT

THRESHOLDS OF SIGNIFICANCE

The project would have a significant adverse earth resources impact if it would:

- expose people or structures to substantial adverse effects including the risk of loss, injury, or death involving:
  - rupture of a known earthquake fault;
  - strong seismic ground shaking;
  - seismic-related ground failure, including liquefaction; or
  - landslides;
- result in substantial soil erosion or loss of topsoil;
- be located on a geologic unit or soil that is unstable, or that would become unstable as a result of the project, and potentially result in on- or off-site landsliding, lateral spreading, subsidence, liquefaction, or collapse; or
- be inundated by a tsunami.

EXPOSURE TO SEISMIC HAZARDS

Fault rupture can occur along fault systems during seismic events (earthquakes). If the rupture extends to the surface, movement on a fault is visible as a surface rupture. The occurrence of a fault rupture depends on several factors including location of the epicenter in relation to the project site and the characteristics of the earthquake, such as intensity and duration. The hazards associated with fault rupture generally occur in the immediate vicinity of the fault system. SQSP is not located in a designated Alquist-Priolo Earthquake Fault Zone. Because active faults were not identified at SQSP, ground rupture would not be anticipated.

Strong earthquakes generated along a fault system generally create ground shaking, which attenuates (i.e., lessens) with distance from the epicenter. In general, the area affected by the ground shaking would depend on the characteristics of the earthquake and location of the epicenter. As described above, no active faults were identified at SQSP, nor is SQSP located in a designated Alquist-Priolo Earthquake Fault Zone. However, the prison is located in an area subject to strong ground shaking from earthquakes generated along the active San Andreas, Hayward, and San Gregorio fault systems. These fault systems could generate strong ground shaking intensities of magnitude 7.1–7.9, which could result in structural damage to buildings. The project would be designed in accordance with the most recent CBC design standards including seismic standards for buildings.

SQSP is not located in a designated Alquist-Priolo Fault Zone, nor are any active faults identified on SQSP. Therefore, ground rupture would not be anticipated at the project sites. SQSP is located in an area subject to strong ground shaking (magnitude 7.1–7.9), which could result in severe structural damage. However, the California Building Code (CBC) includes design standards that are intended to protect buildings from the maximum credible earthquake that could occur on the site. Because the project would be designed in accordance with the most recent provisions of the CBC, including seismic design criteria for buildings, the project's seismic hazard impacts would be less than significant (4.5-a).

EXPOSURE TO LIQUEFACTION AND SEISMIC-RELATED GROUND FAILURES

Primary factors in determining liquefaction potential are soil type, level of duration of seismic ground motions, and depth to groundwater. Sandy, loose, unconsolidated soils are most susceptible to liquefaction hazards. Seismically induced ground failure is typically caused by densification of subsurface soils during and immediately following earthquakes. According to the USGS Susceptibility Map of the San Francisco Bay Area (2005), the CHSC is not located in a liquefaction zone. Further, soils at the CHSC site primarily consist of clay and bedrock, which have a low potential for liquefaction (CDCR 2002). Liquefaction impacts at the CHSC site would be less than significant.

Soils near the medical warehouse consist of sand/silt with low plasticity. While detailed investigation of liquefaction hazards of soils at the warehouse site have not been performed, because sandy/silty soils are present at the warehouse site and the site appears to be located in a in a very high liquefaction susceptibility zone (USGS 2005), liquefaction impacts would be potentially significant.

Lateral spread refers to landslides that form on gentle slopes as a result of seismic activity and have a fluidlike movement. Soil types that are highly susceptible to lateral spread include silts and shale. Soils at the CHSC site included clay and bedrock and soils at the warehouse site consist of sand, silt, and bay mud. These soils could be susceptible to lateral spread during a seismic event. As a result, lateral spread impacts at the CHSC and warehouse sites would be potentially significant.

Liquefaction impacts at the warehouse site would be potentially significant because of its location in a very high liquefaction susceptibility zone. The CHSC is located outside the high liquefaction susceptibility zone, so liquefaction hazards at that site would be less than significant. Further, lateral spread impacts at both the CHSC and warehouse sites would be potentially significant because of the presence of clay, silt, and bay mud, which could be subject to lateral spread during a seismic event. (4.5-b).

RESULT IN SOIL EROSION IMPACTS

Erosion is a natural process where soil is removed by water, wind, or gravity from one location to another. Grading activities remove the natural vegetative cover that protects the soil from erosion. Because the site is paved or covered with building materials and because of the gently sloping topography at the CHSC and warehouse sites, the potential for erosion would be low. However, with building demolition and site grading activities, on-site soils could be exposed to wind and water erosion. The proposed CHSC and warehouse sites and construction staging areas are larger than 1 acre, so CDCR would be required to obtain a National Pollutant Discharge Elimination System (NPDES) permit from the State Water Resources Control Board (SWRCB). The

NPDES permit would require CDCR to develop and implement a stormwater pollution prevention plan (SWPPP), which specifies best management practices (BMPs) that would prevent erosion impacts to the project site and San Francisco Bay (see Mitigation Measure 4.7-c). BMPs for the project would include the use of silt fences and straw bales to prevent runoff from the active grading areas, use of proper grading techniques, shoring and bracing of the construction areas, and covering or stabilizing stockpiles of soil and other earth materials. In addition, the project site is located within the San Rafael urbanized area as designated by the 2000 U.S. Census. As part of the requirements of Phase II of the NPDES stormwater program signed into law in December 1999, smaller communities in urbanized areas known as municipal separate storm sewer systems (MS4s) are required to apply for permit coverage under the NPDES program. The permit requires the MS4 to develop and implement a comprehensive stormwater program that includes public education and outreach, public involvement, illicit discharge detection and elimination, construction runoff control, postconstruction runoff control, and pollution prevention and good housekeeping for ongoing operations. The project site is located within Marin County. The Marin County Stormwater Pollution Prevention Program (MCSPPP) submitted a SWPPP to SWRCB in March 2004 to comply with the general permit for the discharge of stormwater for small MS4's.

Because CDCR would be required to obtain and implement the actions in a NPDES permit from SWRCB, which identifies measures to prevent erosion impacts to the project site and San Francisco Bay, the project's erosion impacts would be less than significant (4.5-c).

PRESENCE OF COMPRESSIBLE, CORROSIVE, AND EXPANSIVE SOILS

Fill soils underlying portions of the CHSC and warehouse site could be unsuitable for foundation support. Some of the fill soils may be poorly compacted and could be subject to uneven settlement and compression or may cause construction difficulties if encountered in foundation excavations. Soil compression hazards at the CHSC and warehouse sites would be potentially significant.

Expansive soils are characterized by their change in volume relative to changes in their moisture content—the extent to which the soil shrinks as it dries or swells when it gets wet. The extent of shrinking and swelling is influenced by the amount and kind of clay in the soil. Clay soils are present at the CHSC site; however, on-site studies of the potential expansive soil hazards at the CHSC site have not been performed. Because clay soils are present at the CHSC site and these types of soils are susceptible to expansion and contraction, potentially significant expansive soil hazards could occur. No on-site soil studies have been performed at the proposed warehouse site. Soils near the warehouse site consist of sand, silt, and bay mud, which could be susceptible to expansion and contraction. Therefore, potentially significant expansive soil hazards at the warehouse site could occur.

Laboratory test results performed by CDCR (2002) from soil and rock samples from the CHSC site indicate that the potential impact of corrosion hazard to concrete is low, but the potential corrosion hazard to steel and other metals is high. Therefore, corrosion impacts at the CHSC site would be considered potentially significant. No on-site soil corrosion studies have been performed for the proposed warehouse site; however, because clayey and corrosive soils are present near the warehouse site (Geo/Resource Consultants 1990, cited in CDCR 2004), potentially significant soil corrosion hazards could occur.

The presence of weak, compressible, and clay soil that may be unsuitable for foundation support could result in structural damage to proposed facilities. Further, corrosive soils on the site could degrade steel and other metal materials. This would be a potentially significant soil hazard impact (4.5-d).

EXPOSURE TO LANDSLIDES

The SQSP site is relatively flat and is not located in a State of California Seismic Hazard Zone for landslides.

Because the SQSP site is relatively flat and is not located in a seismic hazard zone, landslide potential at the proposed project sites would be a less-than-significant impact (4.5-e).

INUNDATION BY A TSUNAMI

The proposed CHSC site is located outside the tsunami wave runup zone, and the proposed medical warehouse site will not be a habitable structure.

Because the CHSC site would be located outside the tsunami wave runup zone (i.e., 15 to 20 feet above sea level), and the medical warehouse site will not be a habitable structure, the potential for tsunami inundation would be less-than-significant (4.5-f).

4.5.4 PROPOSED MITIGATION MEASURES

LESS-THAN-SIGNIFICANT IMPACTS

The following impacts were identified as less than significant, and therefore no mitigation is required:

4.5-a: Exposure to Seismic Hazards
4.5-c: Cause Erosion Hazards
4.5-e: Exposure to Landslide Impacts
4.5-f: Be Inundated by a Tsunami

SIGNIFICANT IMPACTS THAT CAN BE MITIGATED TO A LESS-THAN-SIGNIFICANT LEVEL

The following earth resources impacts were identified as significant. Mitigation is available to reduce these impacts to a less-than-significant level and is recommended below.

4.5-b: Exposure to Liquefaction and Seismic-Related Ground Failures

CDCR will prepare additional design-specific geotechnical studies before preparation of final grading plans for the project (proposed CHSC and warehouse sites). These studies will further delineate the areas potentially subject to liquefaction and seismic-related ground failure and will include subsurface exploration, soil sampling, and laboratory testing of on-site earth materials. Buildings, facilities, or infrastructure proposed in these areas will conform to the design recommendations of the geotechnical engineer. Recommended geotechnical measures will address site grading, cut and fill, subdrainage, fill material quality, foundation type and design criteria, and other geotechnical measures. Measures to reduce liquefaction and ground failure impacts could include the construction of deep foundations, installation of driven piles, and extra reinforcement of foundation slabs.

Implementation of this mitigation measure would reduce this impact to a less-than-significant level.

4.5-d: Existence of Compressible, Corrosive, and Expansive Soils

CDCR will prepare design-specific geotechnical studies before preparation of final grading plans for the project. These studies will delineate areas on each project site that have compressible or corrosive soils. Facility designs will conform to the recommendations of the geotechnical engineer. The following grading and foundation measures could be implemented to reduce the project's compressible and corrosive soils impacts:

- removal, conditioning, or treatment of compressible or unsuitable soils;
- importation or redistribution of clean fill materials suitable for reuse as engineered fill;
- grading to provide suitably compacted soils to support planned building foundations, roadways and other structures;

- construction of shallow, spread-type footings where bedrock is either exposed or confirmed to be at shallow depths (after grading);

- structural reinforcement of building foundations;

- construction of a structural mat foundation system as a possible alternative, if the lighter structures were designed as floating or partially compensated structures to minimize the bearing pressures on the subsurface soils;

- application of protective coatings to steel bars to reduce the potential for corrosion;

- selection of materials (e.g., PVC pipe, concrete mix designs) that are resistant to the corrosive soils and installation of cathodic protection systems to reduce or eliminate the potential for corrosion; and/or

- use of a minimum three-inch concrete cover for construction in contact with native soils.

Implementation of this mitigation measure would reduce this impact to a less-than-significant level.